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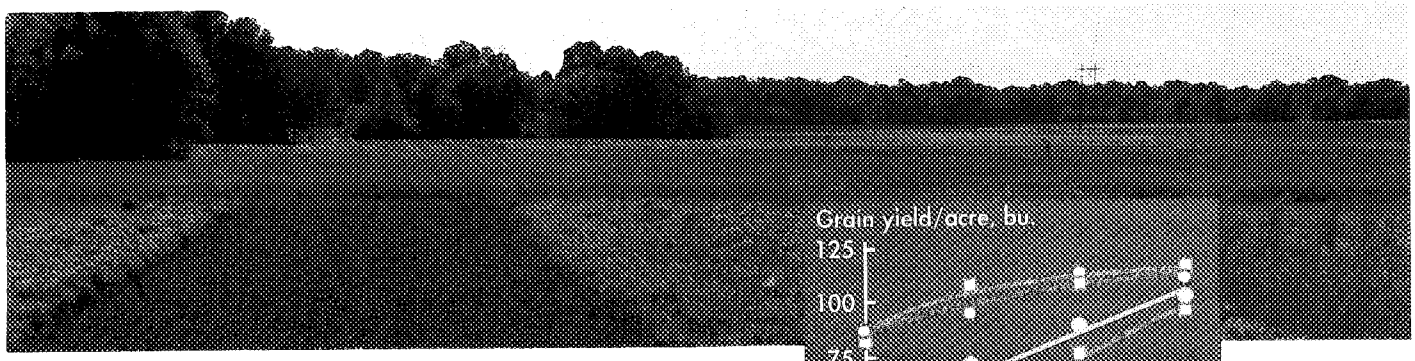
Deep Tillage Ahead of Cover Crop Planting Reduces Soil Compaction for Following Crop



Corn grain yield response to applied N as affected by cover crop, 1988-90 average.

COARSE-TEXTURED Coastal Plains soils are subject to compaction by tillage, traffic, and rainfall. Such compaction limits crop production and reduces efficiency of nitrogen (N) use.

Deep tillage in the spring before planting can help overcome compaction problems, but such land preparation is not always practical. Therefore, there has been interest in growing rotation crops that have roots which can penetrate compacted zones (referred to as "biological plows") and lead to increased rooting depth of following crops.

This possibility was examined in a cooperative project by the Alabama Agricultural Experiment Station and USDA Agricultural Research Service at the E.V. Smith Research Center, Shorter. The study was designed to determine if winter cover crops either alone or in combination with deep tillage (paraplowing) in the fall could reduce soil compaction for the benefit of a following corn crop. The objective was to improve corn growth and yield and increase N use efficiency by the corn.

The study was conducted for 3 years (1988-90) on a Norfolk sandy loam with a well-developed hardpan 7 to 13 in. below the surface. Treatments consisted of fall tillage (disking or disking plus paraplowing) prior to planting winter cover crops of crimson clover, cereal rye, or Tifwhite-78 white lupin and a winter fallow check. The lupin was included because reports from Australia indicated that at least one species could improve rooting of a subsequent crop.

Cover crops were killed with Gramoxone® 11-14 days before planting corn each spring. Prior to planting DeKalb 689 corn, the plots were disked to a depth of 4 to 5 in. Cover crop plots were subdivided and randomly assigned fertilizer treatments of 0, 50, 100, or 150 lb. N per acre. The N (ammonium nitrate) was applied to the corn banded beside the row, with one-third applied at planting and the remainder applied 5 weeks later.

Soil strength readings taken with a penetrometer at corn maturity each year showed that rye and clover moderately increased soil strength at depths of 3-7 in., compared to lupin and winter fallow. However, the reduction in soil compaction at 7- to 17-in. depths resulting from paraplowing was still evident at corn harvest.

Although fall paraplowing prior to planting the cover crop had a strong residual effect in decreasing soil strength, data in the table show a trend for corn grain yields to be lower with paraplowing. This was likely due to increased infiltration and leaching of N as evidenced by reduced earleaf N with paraplowing compared to disking. The effect was greatest in 1989, an extremely wet growing season. Further evidence of increased infiltration in paraplowed plots was demonstrated in 1990, following 9.8 in. of rain in a 48-hour period; soil water content in the 8- to 16-in. depth increased 34.8% in disked plots compared to 46.7% in paraplowed plots.

Corn grain yields were increased by the two legume cover crops, as illustrated by the graph. Optimum yields were obtained with 50-100 lb. N per acre for clover and lupin, while top yields following rye and fallow required 150 lb. N per acre.

Based on grain yields and earleaf N data, white lupin compared favorably with crimson clover in N production and resultant benefit to a corn crop. Nitrogen response and penetrometer and soil water data, however, indicated that none of the cover crops acted as a "biological plow."

Results show that paraplowing prior to planting a fall cover crop reduced compaction for the subsequent corn crop, but this beneficial effect did not result in increased corn yield. Data suggest that increased water infiltration and N leaching from paraplowing offset any yield response from reducing compaction.

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Effect of Cover Crop Tillage on Following Corn Crop

Tillage	Earleaf N content			Grain yield/acre		
	1988	1989	1990	1988	1989	1990
	Pct.	*Pct.*	*Pct.*	*Bu.*	*Bu.*	*Bu.*
Disk	2.87	2.19	2.62	87	86	94
Paraplow	2.78	2.14	2.59	80	76	93